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(54) **INSULATOR BASE FOR ELECTRONIC FAUCET**

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E03C 1/04 (2006.01)
F21V 33/00 (2006.01)

(52) **U.S. Cl.**
CPC ***E03C 1/057*** (2013.01); *Y10T 29/49124* (2015.01); ***E03C 1/0401*** (2013.01); ***E03C 1/0404*** (2013.01); ***F21V 33/004*** (2013.01)

(58) **Field of Classification Search**
CPC E03C 1/0401; E03C 1/0404; E03C 1/057
USPC 4/623, 695; 137/359, 801; 251/129.01, 251/129.04
See application file for complete search history.

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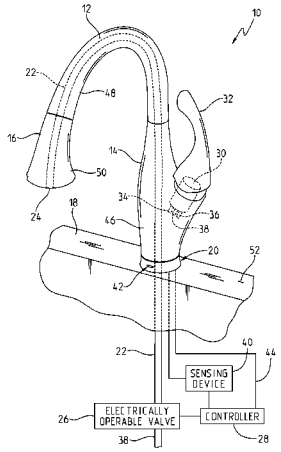
(57) **ABSTRACT**

An insulator base for an electronic faucet includes a housing supporting a light assembly and a connecting wire electrically coupled to the light assembly. A polymer overmold is coupled to the housing and secures the light assembly and the connecting wire within the housing.

21 Claims, 7 Drawing Sheets



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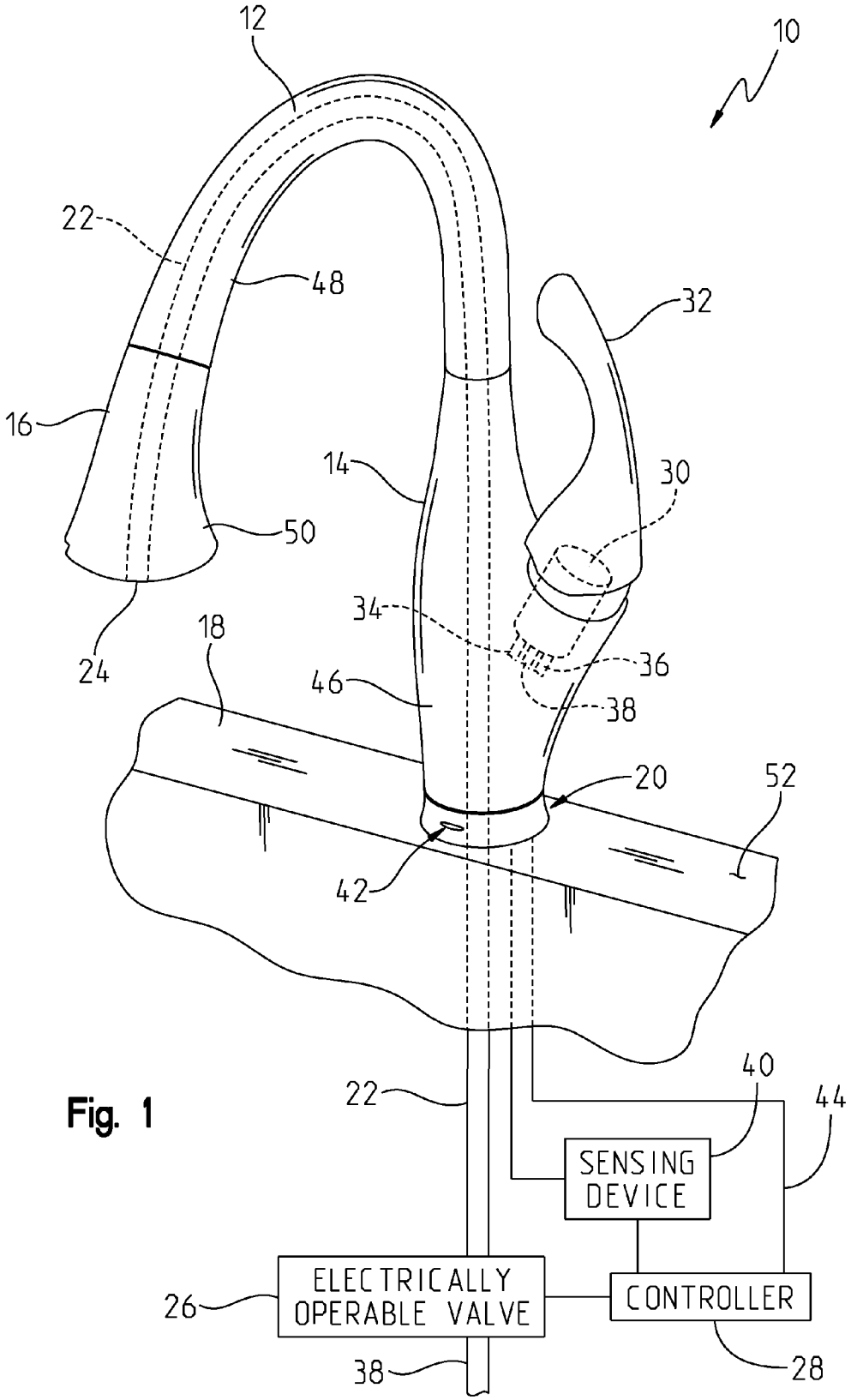
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SENSING DEVICE
ELECTRICALLY OPERABLE VALVE
CONTROLLER
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Fig. 1

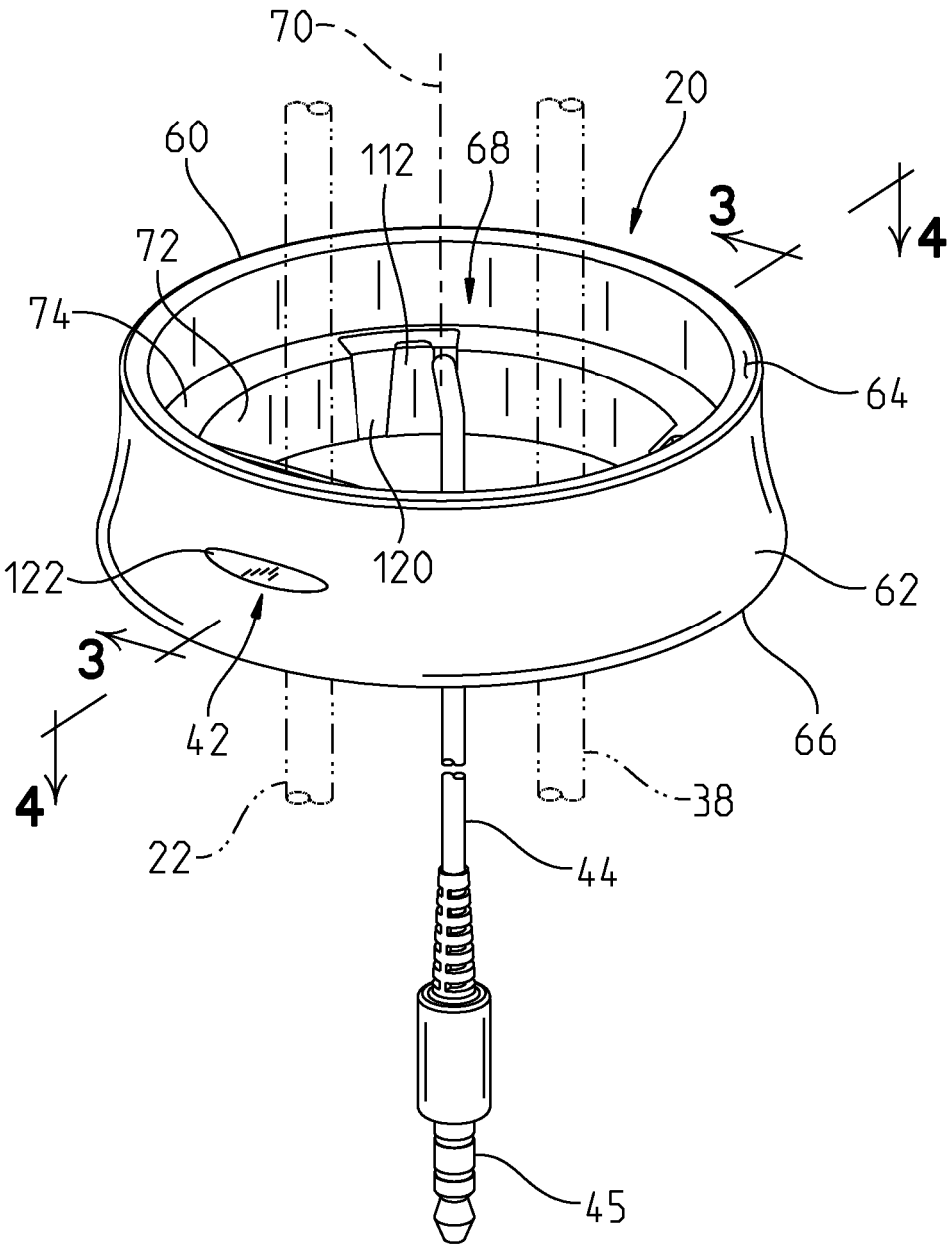

Fig. 2

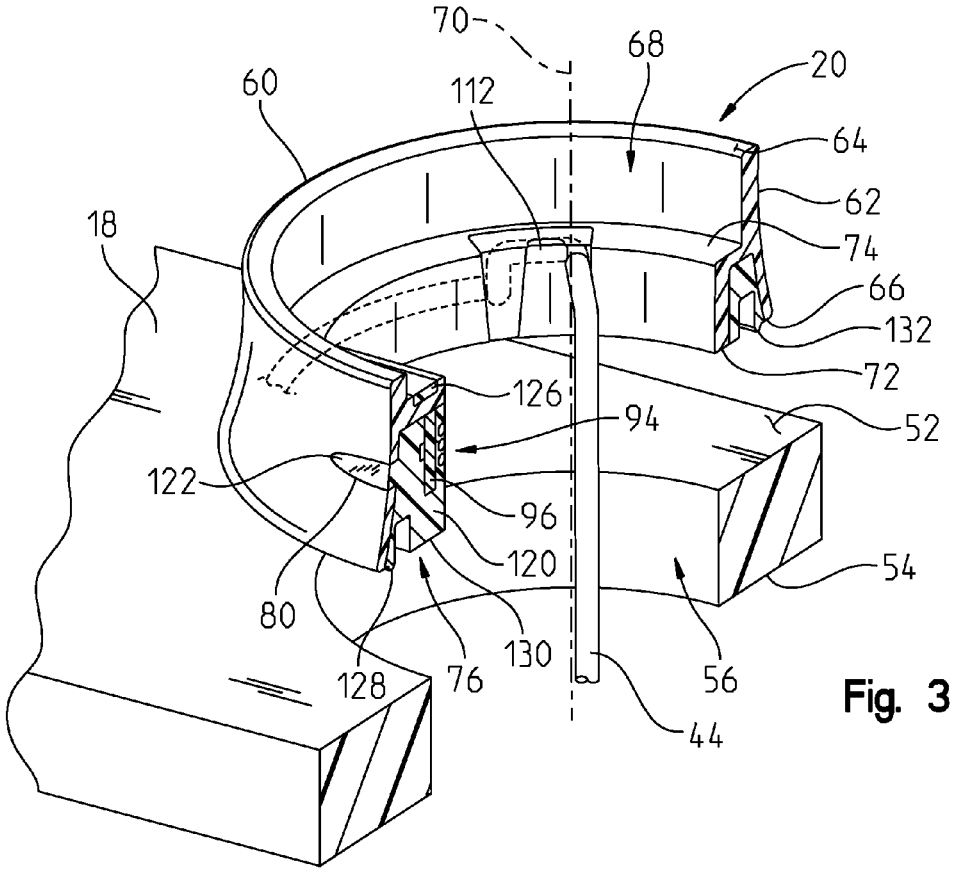
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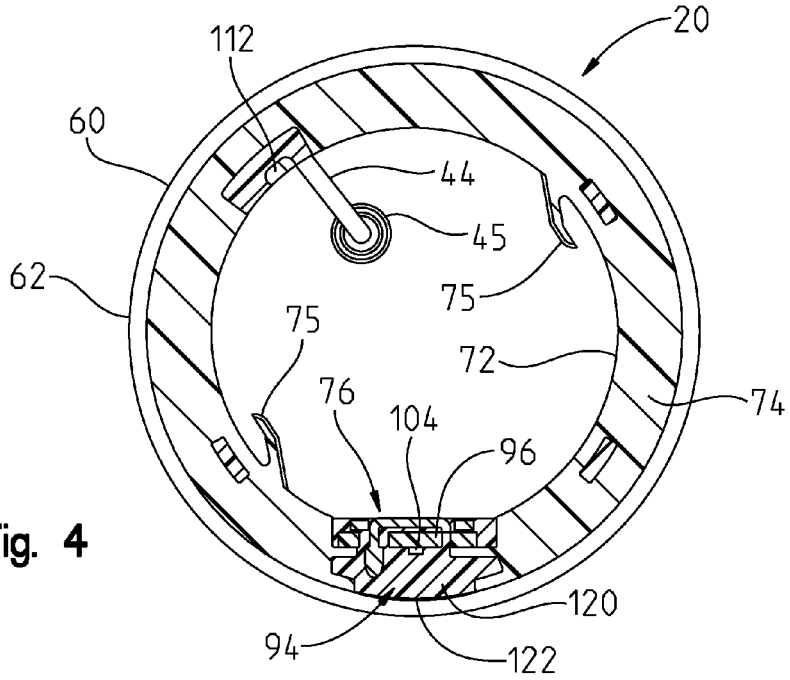
Fig. 3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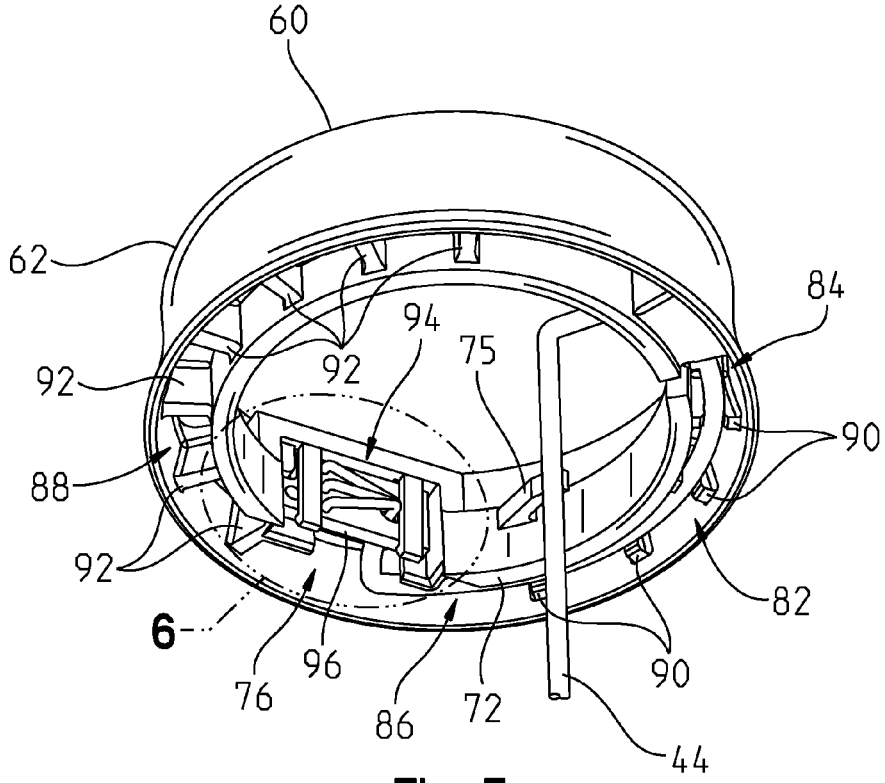
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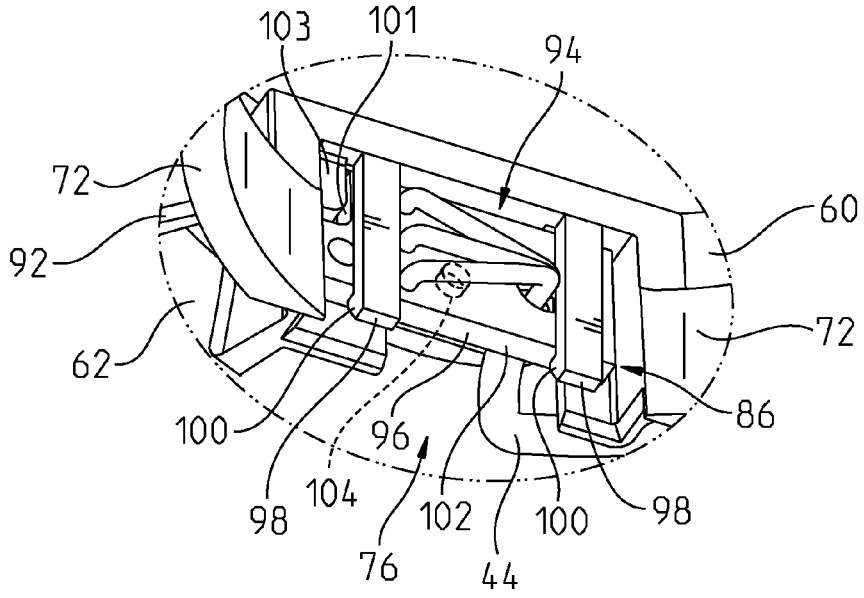
Fig. 5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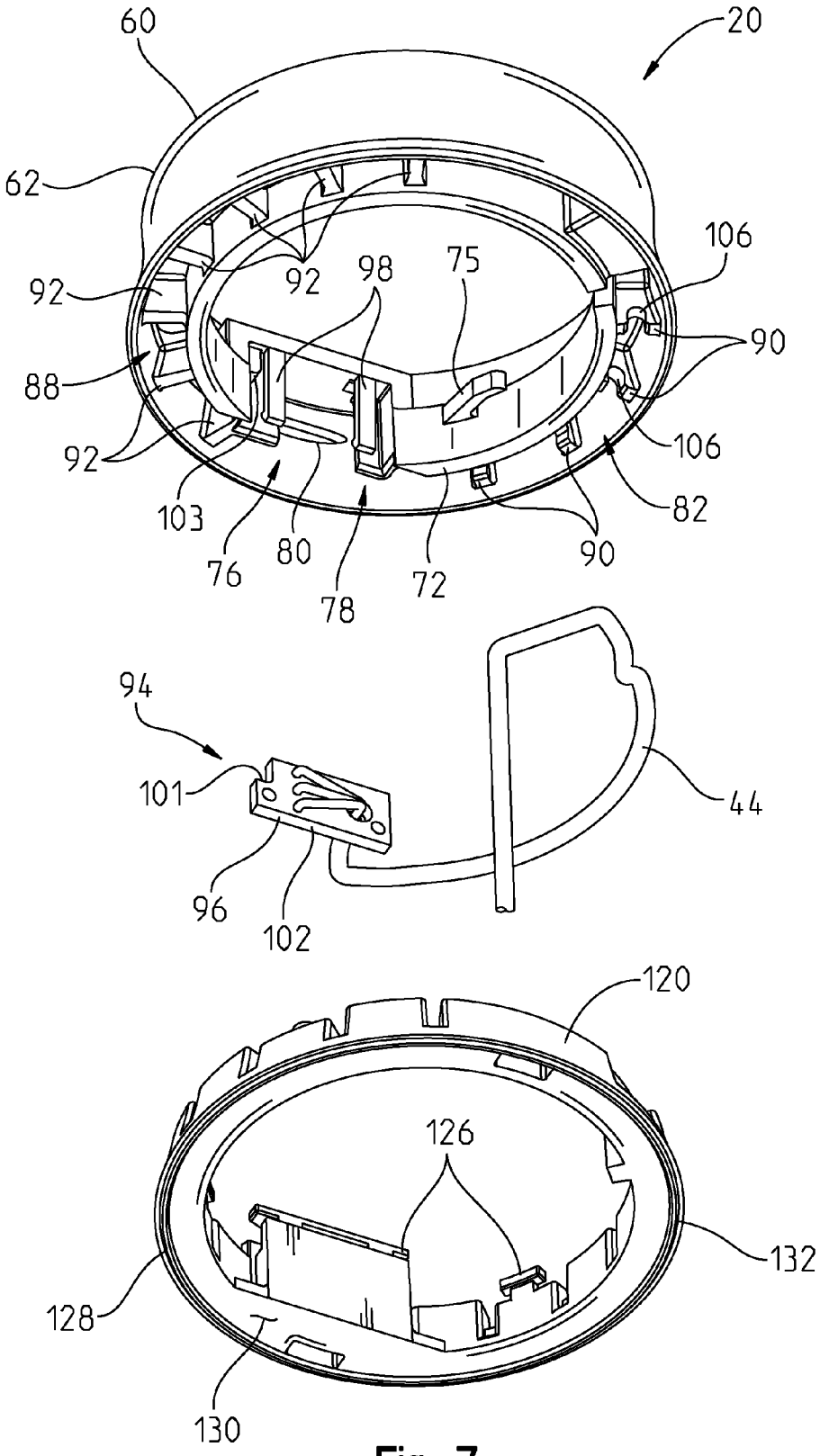
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Fig. 7

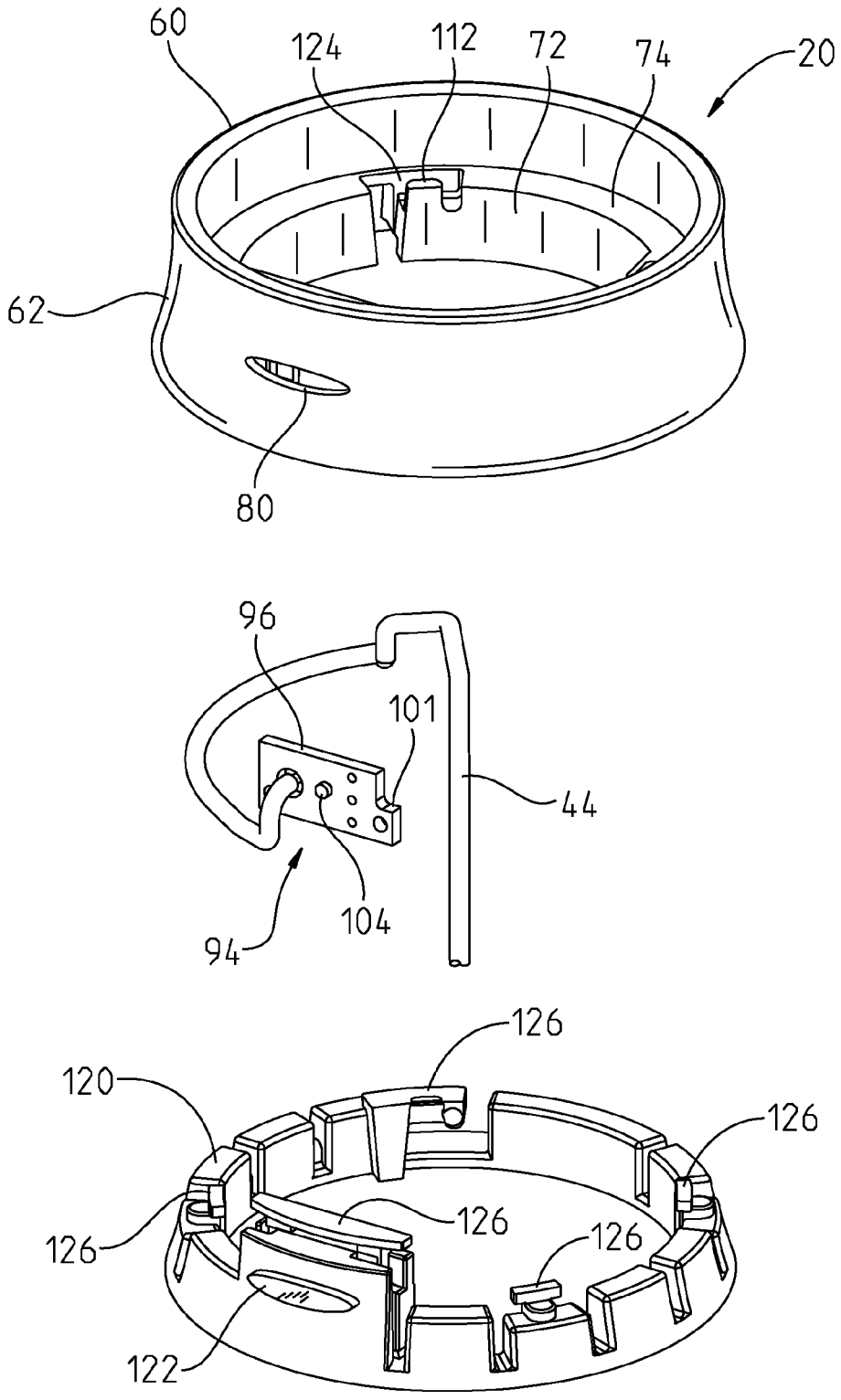
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Fig. 8

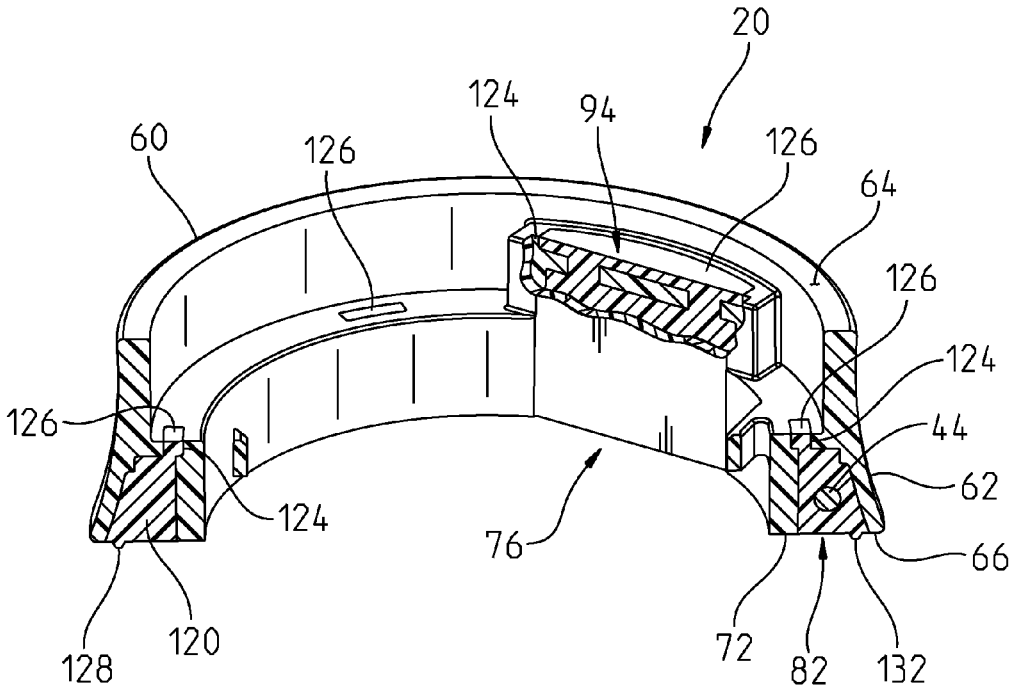
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Fig. 9

INSULATOR BASE FOR ELECTRONIC FAUCET

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to the field of electronic faucets and, more particularly, to an insulator base for an electronic kitchen faucet.

Automatic or electronic faucets, such as those including capacitive control or sensing features, are becoming increasingly popular, particularly in residential households. Such faucets tend to be at least partially formed of metal or other electrically conductive material. Capacitive sensing faucets may be mounted to a mounting deck, such as a kitchen sink, that may be made of metal, such as stainless steel. In such instances, an electrically non-conductive mounting assembly may be used to insulate the metal capacitive sensing components of the faucet from the metal sink.

One such non-conductive mounting assembly may include an insulator base positioned intermediate a faucet delivery spout and a mounting deck. A light emitter may be supported within the insulator base for providing a visual indication of faucet operation to the user. In such instances, it is desired to protect the light emitter and associated circuitry from exposure to water, which may adversely affect the performance of the electronic faucet.

According to an illustrative embodiment of the present disclosure, an insulator base for an electronic faucet includes a housing having an outer sidewall extending about an opening defining a longitudinal axis, a receiving chamber positioned inwardly from the outer sidewall, a channel positioned inwardly from the outer sidewall and in communication with the receiving chamber, and an aperture formed within the outer sidewall and in communication with the receiving chamber. A light assembly includes a light emitter coupled to the support board. The support board is positioned within the receiving chamber of the housing. A connecting wire is electrically coupled to the light assembly, and extends within the channel of the base and into the receiving chamber. A polymer overmold is coupled to the housing and secures the light assembly within the receiving chamber and the electrical wire within the channel. The overmold defines a lens within the aperture of the outer sidewall, the lens permitting the transmission of light from the light emitter therethrough.

According to another illustrative embodiment of the present disclosure, an insulator base for an electronic faucet includes a housing having an outer sidewall, an inner sidewall, a channel defined between the outer sidewall and the inner sidewall, a receiving chamber positioned adjacent the channel, and an aperture formed within the outer sidewall and in communication with the receiving chamber. A light assembly includes a support board and a light emitter coupled to the board. The support board is received within the receiving chamber of the base. A connecting wire is electrically coupled to the light assembly, and extends within the channel of the base. A polymer overmold is coupled to the housing, the overmold securing the connecting wire within the channel, encapsulating the light assembly within the chamber, and defining a lens within the aperture of the outer sidewall. The lens permits the transmission of light from the light emitter therethrough. The polymer overmold further defines a downwardly extending sealing member for sealing with a mounting deck.

According to a further illustrative embodiment of the present disclosure, an electronic faucet includes a delivery spout, a water conduit extending within the delivery spout and having a water outlet, and a base positioned intermediate the delivery spout and the mounting deck. The base includes a housing defining an opening receiving the water conduit, a light assembly supported by the housing and having a light emitter, and an overmold insert molded within the housing and encapsulating the light assembly. A controller is operably coupled to the light assembly, and is configured to control operation of the light emitter.

According to yet another illustrative embodiment of the present disclosure, a method of manufacturing an insulator base for an electronic faucet includes the steps of molding a polymer housing, placing a light assembly within a chamber of the housing, the light assembly including a light emitter, and placing a connecting wire within a receiving channel of the housing. The method further includes the step of insert molding a polymer overmold within the chamber of the housing and the receiving channel of the housing, the overmold encapsulating the light assembly and retaining the connecting wire within the housing.

Additional features and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the illustrative embodiment exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description of the drawings particularly refers to the accompanying figures in which:

FIG. **1** is a perspective view of an illustrative electronic faucet including an insulator base of the present disclosure positioned intermediate a delivery spout and a mounting deck;

FIG. **2** is a perspective view of the insulator base of FIG. **1**;

FIG. **3** is a perspective cross-sectional view taken along line **3-3** of FIG. **2**, showing the insulator base above a mounting deck;

FIG. **4** is a cross-sectional view taken along line **4-4** of FIG. **2**;

FIG. **5** is a bottom perspective view of the insulator base of FIG. **2**, with the overmold removed therefrom for clarity;

FIG. **6** is a detail view of FIG. **5**;

FIG. **7** is a bottom exploded perspective view of the insulator base of FIG. **2**;

FIG. **8** is a top exploded perspective view of the insulator base of FIG. **2**; and

FIG. **9** is a cross-sectional view, with a partial cutaway thereof, of the insulator base of FIG. **2**.

DETAILED DESCRIPTION OF THE DRAWINGS

The embodiments of the invention described herein are not intended to be exhaustive or to limit the invention to precise forms disclosed. Rather, the embodiments selected for description have been chosen to enable one skilled in the art to practice the invention.

Referring initially to FIG. **1**, an illustrative electronic faucet **10** is shown as including a delivery spout **12** supported by a hub **14**. A removable spray head **16** may be releasably coupled to the delivery spout **12** in a conventional manner. The faucet **10** is coupled to a mounting deck **18**, such as a sink deck, through a known fastener or anchor (not shown). The hub **14** is illustratively positioned above the mounting deck **18** by an insulator base **20** of the present disclosure.

In the illustrative embodiment, a flexible fluid conduit or tube **22** extends from below the sink deck **18** through the insulator base **20**, upwardly through the hub **14** and delivery

spout **12** to a fluid outlet **24** supported by the spray head **16**. An electrically operable valve **26** illustratively controls water flow through the conduit **22** to the outlet **24**. The electrically operable valve **26** is in communication with a controller **28** which is configured to open and close the electrically operable valve **26** to control water flow through the conduit **22** and outlet **24**. A power source, such as a battery (not shown), may provide electrical power to the controller **28** and the electrically operable valve **26**.

In certain illustrative embodiments, a manual valve **30** may be positioned upstream from, and fluidly coupled in series with, the electrically operable valve **26**. The manually operable valve **30** is illustratively operably coupled to a handle **32** supported on a side of the hub **14**. Hot and cold water inlet tubes **34** and **36** fluidly couple hot and cold water sources (not shown) to the manual valve **30**. Mixed water output from the valve **30** is illustratively supplied to a flexible outlet tube **38**, which is fluidly coupled to the electrically operably valve **26**. As may be appreciated, the valve **30** operates in a conventional manner wherein movement of the handle **32** may control temperature and/or flow rate of water delivered to the outlet tube **38**.

The electrically operable valve **26** of the electronic faucet **10** may operate through the use of various sensing means, including infrared or capacitive sensing. In one illustrative embodiment, the electronic faucet **10** may operate through the use of capacitive sensing, for example, in the manner described in any one of the following U.S. patents, all of which are hereby incorporated by reference in their entireties: U.S. Pat. No. 6,962,168 to McDaniel et al., entitled "CAPACITIVE TOUCH ON/OFF CONTROL FOR AN AUTOMATIC RESIDENTIAL FAUCET", issued Nov. 8, 2005; U.S. Pat. No. 7,150,293 to Jonte, entitled "MULTI-MODE HANDS FREE AUTOMATIC FAUCET", issued Dec. 16, 2006; and U.S. Pat. No. 7,690,395 to Jonte et al., entitled "MULTI-MODE HANDS FREE AUTOMATIC FAUCET", issued Apr. 6, 2010.

In an illustrative embodiment, the controller **28** may be in communication with a sensing device **40** of the faucet **10**. As detailed above, the sensing device **40** include a capacitive sensor. More particularly, the sensing device **40** may be capacitively coupled to selected electrically conductive faucet components, such as the hub **14**, the delivery spout **12**, the spray head **16**, and/or the handle **32**. Indicators, such as a audible speaker (not shown) or a light emitter **42**, may also be in electrical communication with the controller **28**, illustratively through an electrical connecting wire **44**. A first end of connecting wire **44** may include a conventional electrical coupler **45** for coupling with the controller **28**, while a second end of connecting wire **44** may be coupled to light emitter **42**.

The hub **14** illustratively includes an outer wall or shell **46** formed of an electrically conductive material, such as brass or zinc with a chrome plated finish. The spout **12** and the spray head **16** may each similarly include an outer wall or shell **48** and **50** formed of electrically conductive material, such as brass or zinc with a chrome plated finish.

With reference to FIGS. **1** and **3**, the sink deck **18** illustratively includes a top surface **52**, an underside or a bottom surface **54**, and a sink deck aperture **56** extending between the top surface **52** and the bottom surface **54** of the sink deck **18**. The sink deck **18** may comprise any conventional mounting deck, for example, relatively thick (approximately 0.5 inches thick) cast iron/enamel sink deck, or a relatively thin (approximately 0.031 inches thick) stainless steel sink deck.

With reference to FIGS. **2-5**, the insulator base **20** is supported on the top surface **52** of the sink deck **18** and electrically insulates the hub **14**, the delivery spout **12**, the spray head **16**, and the handle **32** from the sink deck **18** to facilitate proper operation of the capacitive sensing device **40**. In the illustrative embodiment, the insulator base **20** includes a housing **60** having an outer sidewall **62** extending between an upper surface **64** and a lower surface **66** and around a center opening **68** defining a longitudinal axis **70**. An inner sidewall **72** may be formed concentrically within the outer sidewall **62** and connected thereto through a ledge or shoulder **74**. The housing **60** is illustratively molded from a polymer, such as an acetal copolymer or polyoxymethylene (POM). The hub **14** is configured to interface with the upper surface **64** of the outer sidewall **62** and the ledge **74** of the insulator base **20**. A pair of retaining clips **75** extend inwardly from the inner sidewall **72** and are configured to cooperate with the mounting anchor (not shown) securing the faucet **10** to the sink deck **18**. Water conduit **22** extends through opening **68** of insulator base **20**, and into hub **14** and delivery spout **12** (FIG. **1**).

With reference to FIGS. **3**, **5**, and **7**, the housing **60** defines a receiving chamber **76** positioned inwardly from the outer sidewall **62** adjacent a gap **78** (FIG. **7**) within the inner sidewall **72**. The receiving chamber **76** is aligned with an aperture **80** formed within the outer sidewall **62**. A first channel **82** is positioned inwardly from the outer sidewall **62** and is in communication with the receiving chamber **76**. More particularly, the first channel **82** extends arcuately between the outer sidewall **62** and the inner sidewall **72** from a first end **84** to a second end **86** (FIG. **5**). A second channel **88** extends arcuately between the outer sidewall **62** and the inner sidewall **72** and is generally diametrically opposed to the first channel **82**. A plurality of strengthening ribs **90** and **92** extend within the channels **82** and **88** between respective portions of the outer sidewall **62** and the inner sidewall **72**.

A light assembly **94** is illustratively received within the chamber **76**. The light assembly **94** illustratively includes a support board **96** retained in position by a pair of resilient latching members **98** extending downwardly from an upper portion of the housing **60**. More particularly, the latching members **98** include clips **100** to secure a lower edge **102** of the support board **96**. The support board **96** illustratively includes an orientation notch **101** configured to receive a protrusion **103** defined by housing **60**. A light emitter **104**, illustratively a light emitting diode (LED), is supported by the support board **96** and is electrically coupled to the connecting wire **44**. The connecting wire **44** illustratively passes through the first channel **82** and into the receiving chamber **76** to provide electrical communication between the controller **28** and the light emitter **42**.

With reference to FIGS. **5** and **7**, a plurality of retaining brackets **106** are supported by the ribs **90** positioned within the first channel **82**. More particularly, each rib **90** illustratively supports a retaining bracket **106** configured to received and frictionally retain the connecting wire **44**. A holding tab **112** is operably coupled to the connecting wire **44** proximate the first end **84** of the channel **82**, and the receiving chamber **76** is in communication with the second end **86** of the channel **82**. In the illustrative embodiment, the connecting wire **44** extends angularly within the channel **82** by more than 90° and, more particularly, by approximately 135°.

With reference to FIGS. **7-9**, a polymer overmold **120** is coupled to the housing **60** and secures the connecting wire **44** within the first channel **82**, encapsulates the light assembly **94** within the chamber **76**, and defines a lens **122** within the aperture **80** of the outer sidewall **62**. The lens **122** is configured to permit the transmission of light from the light emitter **104** therethrough. The overmold **120** is illustratively formed of a translucent or transparent low density polyethylene (LDPE).

Referring further to FIGS. **7-9**, the overmold **120** is insert molded within cavities (e.g., receiving chamber **76**, channels **82**, **88**) of the housing **60**. In other words, the housing **60** essentially forms a die for receiving the molten material of the overmold **120**. A plurality of reentrant locking chambers **124** are defined by the housing **60** and into which the molten material of the overmold **120** flows. As a result, the overmold **120** includes retaining members **126** that are secured within the locking chambers **124** and help secure the overmold **120** to the housing **60**.

With reference to FIGS. **3** and **7**, a sealing member **128** is integrally formed within the lower surface **130** of the overmold **120** for sealing with the top surface **52** of the mounting deck **18**. The sealing member **128** illustratively includes an annular gasket **132** integrally molded within, and extending downwardly from, the overmold **120**.

A method of manufacturing the insulator base **20** for electronic faucet **10** illustratively includes the steps of molding housing **60**, illustratively through a conventional injection molding process using an acetal copolymer. Light assembly **94** is then placed within the chamber **76** of the housing **60**, wherein support board **96** of the light assembly **94** is initially retained through the resilient latching members **98**. The connecting wire **44** connected to the light assembly **94** is then fed from the chamber **76** through the channel **82** and is initially retained in place by retaining brackets **106**. Next, a polymer, illustratively a low density polyethylene, is insert molded within the housing **60**, including channels **82**, **88** and chamber **76** of the housing **60**. The overmold **120** encapsulates the light assembly **94** and retains the connecting wire **44** within the housing **60**. Simultaneously, lens **122** is formed within the opening **80** of the housing **60**. Also simultaneously, downwardly extending sealing member **128** is formed in the lower surface **130** of the overmold **120**.

Although the invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the spirit and scope of the invention as described and defined in the following claims.

The invention claimed is:

1. An insulator base for an electronic faucet, the insulator base comprising:

a housing including an outer sidewall and an inner sidewall each extending about an opening defining a longitudinal axis, a receiving chamber positioned inwardly from the outer sidewall, a channel positioned inwardly from the outer sidewall and in communication with the receiving chamber, the channel defined between the outer sidewall and the inner sidewall, and an aperture formed within the outer sidewall and in communication with the receiving chamber;

a light assembly including a support board and a light emitter coupled to the support board, the support board positioned within the receiving chamber of the housing;

a connecting wire electrically coupled to the light assembly, the connecting wire extending within the channel of the housing and into the receiving chamber; and

a polymer overmold coupled to the housing, encapsulating and securing the light assembly within the receiving chamber and the connecting wire within the channel, the overmold defining a lens within the aperture of the outer sidewall, the lens permitting the transmission of light from the light emitter therethrough.

2. The insulator base of claim **1**, wherein a plurality of retaining brackets are positioned within the channel for coupling to the connecting wire.

3. The insulator base of claim **1**, wherein the housing is formed of an acetal copolymer, and the overmold is formed of a low density polyethylene.

4. The insulator base of claim **1**, further comprising a downwardly extending sealing member integrally formed within a lower surface of the overmold for sealing with a mounting deck.

5. The insulator base of claim **1**, wherein the housing further includes a latching member extending within the receiving chamber and configured to couple to a lower end of the support board of the light assembly.

6. The insulator base of claim **1**, wherein the housing includes an upper end configured to be positioned below a delivery spout, a lower end configured to be positioned above a mounting deck, and the opening configured to receive a water conduit extending into the delivery spout.

7. The insulator base of claim **1**, wherein the channel of the housing includes a first end and a second end, the housing including a holding tab operably coupled to the connecting wire at the first end, and the second end is in communication with the chamber.

8. The insulator base of claim **1**, wherein the overmold encapsulates the light assembly to prevent contact from water.

9. An insulator base for an electronic faucet, the insulator base comprising:

a housing including an outer sidewall, an inner sidewall, a channel defined between the outer sidewall and the inner sidewall, a receiving chamber positioned adjacent the channel, and an aperture formed within the outer sidewall and in communication with the receiving chamber;

a light assembly including a support board and a light emitter coupled to the board, the support board received within the receiving chamber of the housing;

a connecting wire electrically coupled to the light assembly, the connecting wire extending within the channel of the housing; and

a polymer overmold coupled to the housing, the overmold securing the connecting wire within the channel, encapsulating the light assembly within the chamber, defining a lens within the aperture of the outer sidewall, the lens permitting the transmission of light from the light emitter therethrough, and defining a downwardly extending sealing member for sealing with a mounting deck.

10. The insulator base of claim **9**, wherein a plurality of retaining brackets are positioned within the channel for coupling to the connecting wire.

11. The insulator base of claim **9**, wherein the housing is formed of an acetal copolymer, and the overmold is formed of a low density polyethylene.

12. The insulator base of claim **9**, wherein the housing further includes a latching member extending within the receiving chamber and configured to couple to a lower end of the support board of the light assembly.

13. The insulator base of claim **9**, wherein the housing includes an upper end configured to be positioned below a delivery spout, a lower end configured to be positioned above a mounting deck, and the opening configured to receive a water conduit extending into delivery spout.

14. The insulator base of claim **9**, wherein the channel of the housing includes a first end and a second end, the housing including a holding tab operably coupled to the connecting wire at the first end, and the second end is in communication with the chamber.

15. An electronic faucet comprising:

a delivery spout;

a water conduit extending within the delivery spout and including a water outlet;

a base positioned intermediate the delivery spout and a mounting deck, the base including a housing defining an opening receiving the water conduit, the base further including an outer sidewall, an inner sidewall spaced apart from the outer sidewall, a channel defined between the inner sidewall and the outer sidewall, a receiving chamber positioned adjacent the channel, an aperture formed within the outer sidewall and in communication with the receiving chamber, a light assembly supported by the housing and having a light emitter, and an overmold insert molded within the housing and encapsulating the light assembly within the chamber, the overmold defining a lens within the aperture of the outer sidewall, the lens permitting the transmission of light from the light emitter therethrough;

a controller operably coupled to the light assembly, the controller configured to control operation of the light emitter; and

a connecting wire electrically coupling the controller and the light assembly, the connecting wire passing through the opening and below the mounting deck, wherein the channel is configured to receive the connecting wire.

16. The electronic faucet of claim **15**, further comprising a sealing member integrally formed within a lower surface of the overmold for sealing with the mounting deck.

17. The electronic faucet of claim **15**, wherein the light assembly includes a support board, and the base further includes a latching member extending within the receiving chamber and configured to couple to a lower end of the support board of the light assembly.

18. A method of manufacturing an insulator base for an electronic faucet, the method comprising the steps of:

molding a polymer housing including an outer sidewall, an inner sidewall, a channel defined between the outer sidewall and the inner sidewall, a receiving chamber positioned adjacent the channel, and an aperture formed within the outer sidewall and in communication with the receiving chamber;

placing a light assembly within the receiving chamber of the housing, the light assembly including a support board and a light emitter;

placing a connecting wire within the channel of the housing; and

insert molding a polymer overmold within the receiving chamber of the housing and the channel of the housing, the overmold encapsulating the light assembly, defining a lens within the aperture of the outer sidewall, the lens configured to transmit light form the light emitter, the polymer overmold defining a downwardly extending sealing member for sealing with a mounting deck and retaining the connecting wire within the housing.

19. The method of claim **18**, further comprising the step of retaining the light assembly by a resilient clip within the chamber of the housing prior to the insert molding step.

20. The method of claim **19**, further comprising the step of retaining the wire within the channel by a plurality of brackets prior to the insert molding step.

21. The method of claim **18**, wherein the insert molding step includes forming a downwardly extending sealing member in the lower surface of the overmold.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,057,184 B2
APPLICATION NO. : 13/277000
DATED : June 16, 2015
INVENTOR(S) : Steven Kyle Meehan et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE CLAIMS

In Claim 18, Column 8, line 17, please amend as follows:

--configured to transmit light from the light emitter, the--

Signed and Sealed this
First Day of March, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office